ENTOMOLOGY.—*A key to the larval Bostrichidae in the United States National Museum* (*Coleoptera*).[1] WILLIAM H. ANDERSON, U. S. Bureau of Entomology and Plant Quarantine. (Communicated by C. F. W. MUESEBECK.)

Twenty-one species are included in the accompanying key, which deals only with full-grown or nearly full-grown larvae. Twenty of the species are represented in the larval collection of the United States National Museum. The only species treated of which no larvae are contained in that collection is the cosmopolitan *Rhizopertha dominica* (F.), the distinguishing characters of which have been taken from the valuable paper by Gardner.[2] Except for *Dexicrates robustus* (Blanch.), all the species in the key occur in North America.

The family characters of larval Bostrichidae have been given in detail by Böving[3] and will not be repeated here. However, the scope of the family is here extended to include the Psoidae of Böving and Craighead.[4] The genera comprising this family, namely *Stephanopachys*, *Rhizopertha*, *Dinoderus*, *Polycaon*, and *Psoa*, were excluded from the Bostrichidae by those authors because they possess strong epipharyngeal sclerotization, a large pseudomolar process, and large fleshy lacinia mandibulae. That these characters are hardly sufficient for family separation was brought out by Gardner (l. c.), who showed that the larval mandible of the Bostrichini has a small fleshy appendage (lacinia mandibulae) and a small rodlike projection (pseudomola). Furthermore, although in habitus the imagoes of the Psoinae are somewhat divergent from those of the Bostrichinae, those of the Dinoderinae must be considered convergent. And a study of the larvae of Psoinae and Dinoderinae indicates the close relationship between the subfamilies. In addition, the biologies of the Psoinae and Dinoderinae are very similar to those of the Bostrichinae. It seems best, therefore, to include the Psoidae of Böving and Craighead in the Bostrichidae.

I agree with Gardner (l. c.) and Lesne[5] in considering *Dinoderus* and related genera (Dinoderinae) sufficiently distinct from the Psoinae to be worthy of subfamily rank. In the Dinoderinae the anterior

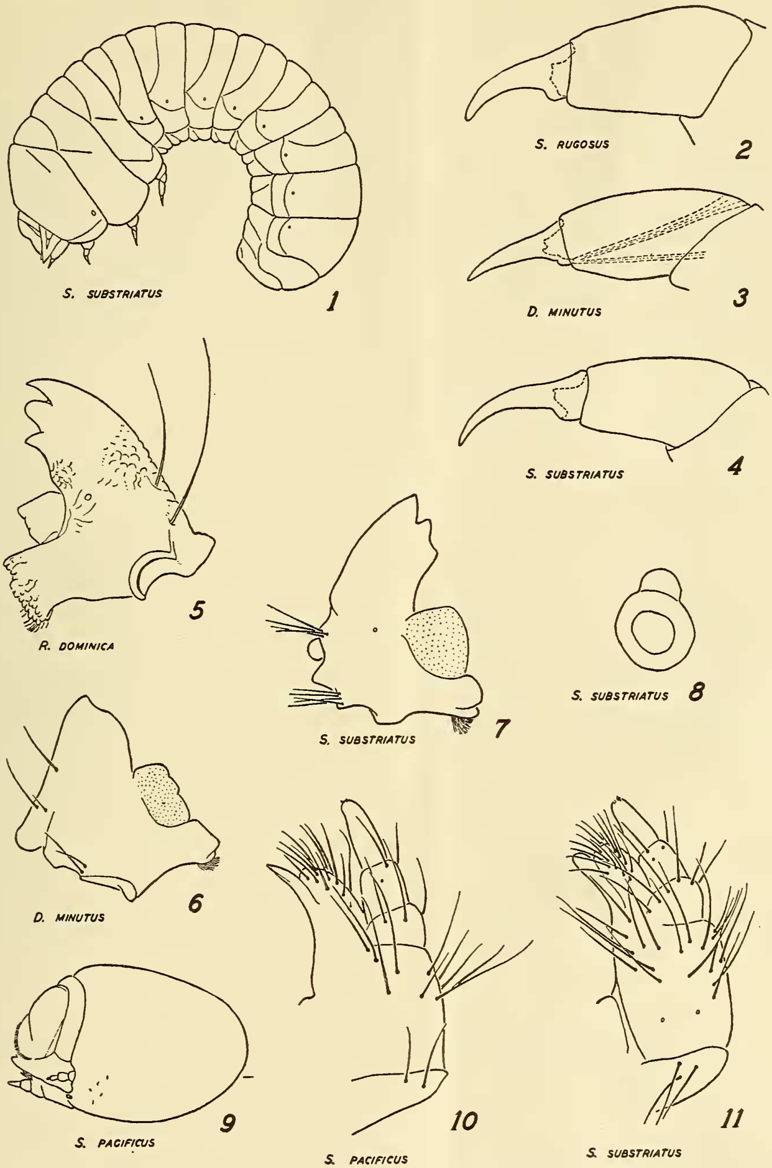
[1] Received March 22, 1939.

[2] GARDNER, J. C. M. *Immature stages of Indian Coleoptera* (*13*) (*Bostrychidae*). Indian Forest Rec., Ent. Ser. **18** (9): 1–19, 4 pls. 1933.

[3] BÖVING, ADAM G. *Taxonomy and morphology of the larval stages of* Scobicia declivis (*Lec.*). U. S. Dept. Agr. Bull. **1107** (appendix): 49–56, pls. 1–2. 1922.

[4] BÖVING, ADAM G., and CRAIGHEAD, F. C. *An illustrated synopsis of the principal larval forms of the order Coleoptera.* Ent. Amer. **11** (n.s.): 1–341, 125 pls. 1931.

[5] LESNE, PIERRE. *Les coléoptères bostrychides de l'Afrique Tropicale Française.* Paris, 288 pp., 210 figs. 1924.



Figs. 1–11.—1, *Stephanopachys substriatus* (Payk.), lateral view (body setae omitted). 2, *S. rugosus* (Oliv.), tibiotarsus and claw, left prothoracic leg (setae omitted). 3, *Dinoderus minutus* (F.), tibiotarus and claw, left prothoracic leg (setae omitted). 4, *Stephanopachys substriatus*, tibiotarsus and claw, left prothoracic leg (setae omitted). 5, *Rhizopertha dominica* (F.), right mandible, dorsal view (adapted from Gardner, *l. c.*, fig. 34). 6, *Dinoderus minutus*, left mandible, dorsal view. 7, *Stephanopachys substriatus*, left mandible, dorsal view. 8, *S. substriatus*, spiracle from third abdominal segment. 9, *S. pacificus* Csy., head, dorsolateral view (setae, for the most part, omitted). 10, *S. pacificus*, left maxilla, ventral view. 11, *S. substriatus*, left maxilla, ventral view. Except for Fig. 5, all drawings are by the author.

abdominal terga have only two folds and the prothorax lacks a lateral thickening, whereas in the Psoinae there are four tergal folds and the prothorax possesses a lateral thickening.

There seem to be excellent reasons for maintaining the Lyctidae as a distinct family, although Gardner (l. c.) and Lesne (l. c.) have treated them as a subfamily (Lyctinae) of the Bostrichidae. The Lyctidae are undoubtedly closely related to the Bostrichidae, especially through the Dinoderinae and Psoinae, which resemble the Lyctidae in the shape of the head, the structure of the mouth parts, the development of the legs and their position at rest, and the enlargement of the thorax. It is probable that the similarity of food and of feeding habits is largely responsible for these resemblances. Other, less adaptive characters show the two groups to be distinct.

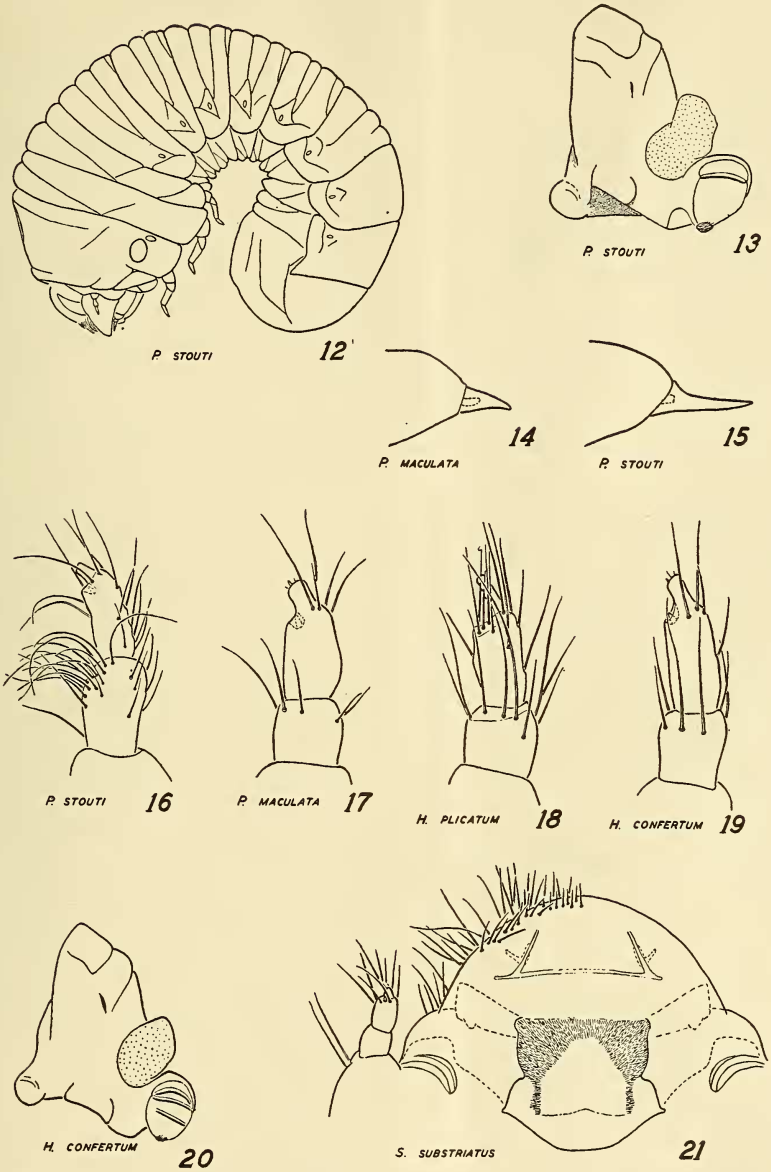
An important difference is found in the lobes around the anal opening. The tenth abdominal segment of the Bostrichidae, in front of the anus, has a pair of adjacent lobes separated by a longitudinal groove. In the Lyctidae, however, the tenth abdominal segment lacks the longitudinal groove and folds in front of the anus, the anal opening being surrounded by a transverse anterior and two lateral lobes.

A structure that probably has considerable significance is found in the posterior portion of the intestine. It consists of a pair of slender, apparently sclerotized rods, which lie in, or inseparably on, the wall of the intestine. In the Bostrichidae they begin at the lateral margins of the longitudinal groove in front of the anus and extend anteriorly in spirals. The spirals run clockwise for two or three turns, then reverse and run counterclockwise for one or two more turns. The rods then unite and end blindly. In the Lyctidae these supporting rods simply follow along the ventral wall of the intestine without winding spirally, around it.

The eighth abdominal spiracle in the Lyctidae is comparatively huge, whereas in the Bostrichidae it is not larger than other abdominal spiracles.

The pupae of the two families show little of significance, interpreted by our present knowledge, which would separate them. There is a difference in the habitus that is in agreement with the habital difference between the imagoes, the Lyctidae being usually more strongly depressed and less compact.

There is a significant difference in the male genitalia of the two families. In the Bostrichidae the axis of the aedeagus is parallel to that of the body. The genitalia of the Lyctidae, on the other hand, are somewhat asymmetrical in that the sclerotized parts are curved in



Figs. 12–21.—12, *Polycaon stouti* (Lec.), lateral view (body setae omitted). 13, *P. stouti*, right mandible, buccal view. 14, *Psoa maculata* (Lec.), tarsal claw, right prothoracic leg. 15, *Polycaon stouti*, tarsal claw, right prothoracic leg. 16, *P. stouti*, antenna. 17, *Psoa maculata*, antenna. 18, *Heterarthron plicatum* (Lec.), antenna. 19, *H. confertum* (Lec.), antenna. 20, *H. confertum*, right mandible, buccal view. 21, *Stephanopachys substriatus*, epipharynx. All drawings by the author.

such a manner that the posterior extremities of the lobes are not in the midline of the body. Furthermore a distinct torsion of the aedeagus has taken place in the Lyctidae, probably as a result of the curvation.

It seems advisable to discuss briefly a few of the structures used in the key. Some of them have not been studied before in this family, and one structure has, at times, been misinterpreted.

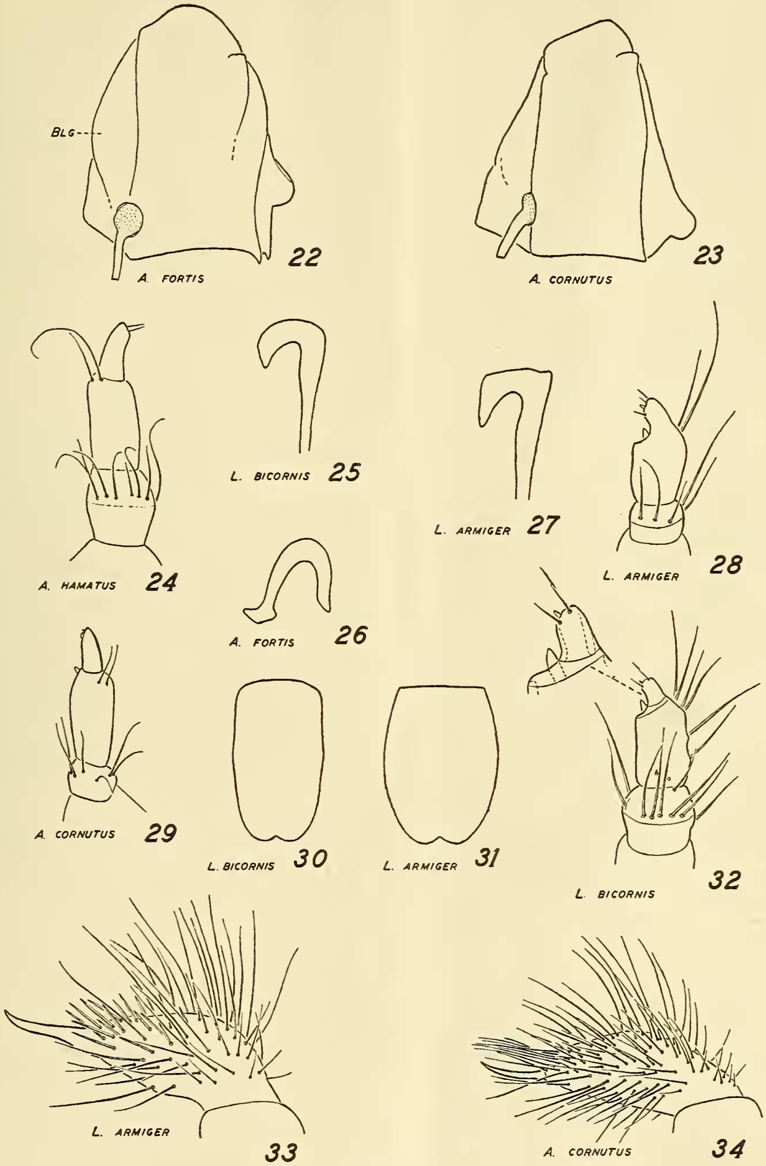
Arising from the ventral surface of the labral sclerite there is a pair of stout sclerotized processes, the so-called "epipharyngeal rods." They extend vertroposteriorly through the pocketlike space between labrum and epipharynx and become secondarily attached to the dorsal surface of the epipharyngeal membrane. On the ventroposterior end of each rod, muscles are inserted which usually originate within the head and are responsible for the principal movements of the labrum.

Beneath the floor of the pharynx, immediately behind the buccal cavity, there is a forwardly directed U-shaped sclerome (Fig. 43). This has been termed the fulcrum. Extending posteriorly and somewhat dorsally along the walls of the pharynx from the arms of this sclerome there is, in most species, a supplementary pair of rods (Fig. 38). Muscles are attached to these rods[6] which assist in the tilting of the floor of the pharynx, and hence in opening or closing it.

The antenna consists of three articles except when the second and third have fused. In the latter case the distal end of the second can be located by the uniformly present, supplementary, conical, sensory appendix. In addition to the three articles there is a rather prominent basal membrane by which the antenna is connected to the head. By some investigators of this and other families this membrane has been considered as the basal article. An examination of the antennal muscles shows this conception incorrect since, from their origin within the head, the muscles can be traced to the base of the first article, and are not inserted on the membranous ring.

The bostrichid larvae in the United States National Museum are readily separable into the three subfamilies Dinoderinae, Psoinae, and Bostrichinae. That these are natural groups is shown both by larval characteristics and by the structure of the male genitalia.

[6] It is, of course, impossible to consider these rods as being, as Pringle stated, "upwardly directed into the mouth cavity." PRINGLE, J. A. *Observations on certain wood-boring Coleoptera occurring in South Africa.* Trans. Roy. Ent. Soc. London **87** (11): 247–270, 1 pl., 5 figs. 1938.



Figs. 22–34.—22, *Apatides fortis* (Lec.), left mandible, buccal view (BLG, dorsal bulge). 23, *Amphicerus cornutus* (Pallas), left mandible, buccal view. 24, *A. hamatus* (F.), antenna. 25, *Lichenophanes bicornis* (Web.), epipharyngeal rod, lateral view. 26, *Apatides fortis*, epipharyngeal rod, lateral view. 27, *Lichenophanes armiger* (Lec.), epipharyngeal rod, lateral view. 28, *L. armiger*, antenna. 29, *Amphicerus cornutus*, antenna. 30, *Lichenophanes bicornis*, outline of foramen. 31, *L. armiger*, outline of foramen. 32, *L. bicornis*, antenna. 33, *L. armiger*, tibiotarsus and claw, left prothoracic leg. 34, *Amphicerus cornutus*, tibiotarsus and claw, left prothoracic leg. All drawings by the author.

KEY TO SPECIES STUDIED

1. Abdominal segments 1 to 5 with two tergal folds (Fig. 1); labial palpus with one article; prothorax without lateral thickening (Dinoderinae) . 2
   Abdominal segments 1 to 5 with three or four tergal folds (Fig. 12); labial palpus with two articles; prothorax laterally with oblique rodlike thickening or with oval raised area 6

Dinoderinae (*couplets 2–5 inc.*)

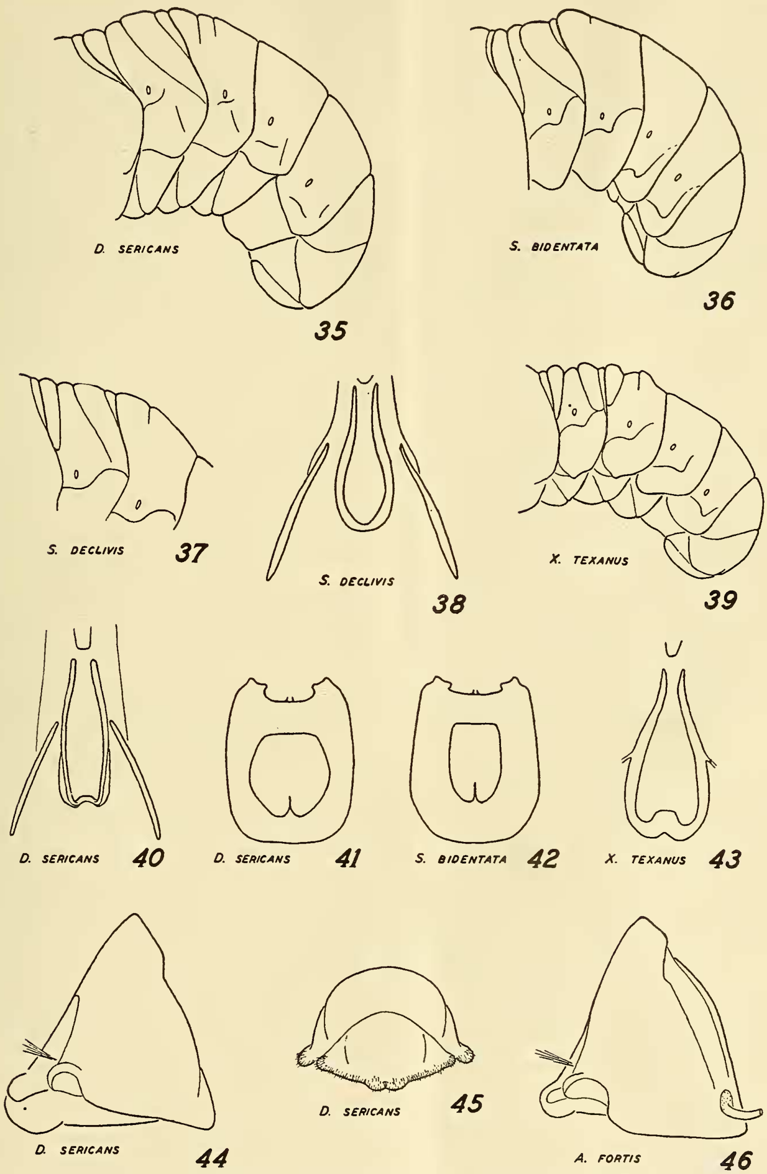
2. Head without subcutaneous pigment spots or ocelli; spiracles simple, oval 3
   Head with pigment spots (usually 5) and an ocellus (Fig. 9); each spiracle with a dorsal oval projection (Fig. 8) 4
3. Mandible with three teeth; molar part granular (Fig. 5) . . . . *Rhizopertha dominica* (F.)
   Mandible oblique, with one projecting tooth; molar part smooth (Fig. 6) . . . . *Dinoderus minutus* (F.)
4. Claw of prothoracic leg robust, subequal in length to width of tibiotarsus (Fig. 2)[7]; ventral pigment spot of head largest . . . . *Stephanopachys rugosus* (Oliv.)
   Claw of prothoracic leg slenderer, $1\frac{1}{4}$ to $1\frac{1}{2}$ times width of tibiotarsus (Fig. 4); ventral pigment spot not larger than others (Fig. 9) 5
5. Stipes with numerous setae (Fig. 11) . *Stephanopachys substriatus* (Payk.)
   Stipes with few setae (Fig. 10) . . . . *Stephanopachys pacificus* Csy.
6. Mandible with large pseudomola and with large fleshy appendage (Fig. 13); epipharynx with large median sclerome (Fig. 21); maxillary palpus with three articles (Psoinae) 7
   Mandible without large pseudomola, either with (Fig. 46) or without (Fig. 44) a small rodlike projection; epipharynx without median sclerome; maxillary palpus with two articles (Bostrichinae) 11

Psoinae (*couplets 7–10 inc.*)

7. Mandibular molar part with three transverse ridges (Fig. 20) 8
   Molar part with one transverse ridge (Fig. 13) 9
8. Prothoracic tarsal claw stout; clypeus lightly pigmented; antenna clearly with three articles (Fig. 18) . . . . *Heterarthron plicatum* (Lec.)
   Prothoracic tarsal claw slender; clypeus heavily pigmented; antenna with second and third articles apparently fused (Fig. 19) . . . . *Heterarthron*[8] *confertum* (Lec.)

[7] The tarsal claw of bostrichid larvae has been considered immovably united with the tibiotarsus. In certain species (cf. Fig. 3) that have been investigated in this study the full quota of muscles is present and extends from the claw into tibiotarsus and femur. It seems logical, therefore, that the claw is independently movable.

[8] The use of *Heterarthron* in place of *Polycaon* for these two species seems justified, since they are not congeneric with *Polycaon stouti* (Lec.). *Lichenophanes bicornis* (Web.) has been used in place of *Bostrichus bicornis* (Web.) because *bicornis* appears congeneric with *L. armiger* (Lec.). Lesne has expressed these same opinions in his recent catalogue: Lesne P Bostrychidae, in *Coleopterorum catalogus* (W. Junk) 10 (161). 1938.



Figs. 35–46.—35, *Dendrobiella sericans* (Lec.), posterior half of abdomen. 36, *Scobicia bidentata* (Horn), posterior half of abdomen. 37, *S. declivis* (Lec.), fifth and sixth abdominal terga. 38, *S. declivis*, pharyngeal fulcrum. 39, *Xylobiops texanus* (Horn), posterior half of abdomen. 40, *Dendrobiella sericans*, pharyngeal fulcrum. 41, *D. sericans*, head capsule, ventral view. 42, *Scobicia bidentata*, head capsule, ventral view. 43. *Xylobiops texanus*, pharyngeal fulcrum. 44. *Dendrobiella sericans*, left mandible, dorsal view. 45, *D. sericans*, tip of abdomen, posterior view. 46, *Apatides fortis*, left mandible, dorsal view. All drawings by the author.

9. First article of antenna robust, bearing many setae (Fig. 16); mentum very hairy..10
   First article of antenna normally developed, with but few setae (Fig. 17); mentum sparsely setose; [prothoracic tarsal claw stout (Fig. 14)].... ....*Psoa maculata* (Lec.)
10. Pigmentation on outer face of stipes long, extending about one-half distance from cardo to base of palpiger; submentum bearing many long, silky hairs. .*Dexicrates robustus* (Blanch.) (from South America)
    Pigmentation on outer face of stipes not evident; submentum with fewer, shorter hairs; [prothoracic tarsal claw slender (Fig. 15)]........... ....*Polycaon stouti* (Lec.)

Bostrichinae (*couplets 11–20 inc.*)

11. Maxillary mala with freely projecting stylet; mandible with small rodlike projection (Fig. 46) (Bostrichini).........................12
    Maxillary mala without stylet; mandible without rodlike projection (Fig. 44) (Xyloperthini)..16
12. Terminal setae of prothoracic tibiotarsus subequal in length with claw and forming a compact "brush" (Fig. 34); epipharyngeal rod short (Fig. 26); antenna with third article distinct, subequal in length to first article (Fig. 24)..13
    Terminal setae of prothoracic tibiotarsus stout, much shorter than claw and not forming a "brush" (Fig. 33); epipharyngeal rod long (Fig. 25); antenna with third article shorter than first and apparently fused with second article (Fig. 28)...................................15
13. Mandible with outer face dull and with dorsal bulge (Fig. 22, Blg.) prominent, gently receding from plane of inner face............... ....*Apatides fortis* (Lec.)
    Mandible with outer face shiny and with dorsal bulge not prominent (Fig. 23), sharply receding from plane of inner face.............14
14. First article of antenna long, slightly less than one-third total length of antenna (Fig. 24)....................*Amphicerus hamatus* (F.)
    First article of antenna short, about one-fifth total length of antenna (Fig. 29)..........................*Amphicerus cornutus* (Pallas)
15. Opening of foramen broad, lateral margins smoothly curved (Fig. 31) ....*Lichenophanes armiger* (Lec.)
    Opening of foramen narrow, lateral margins nearly straight (Fig. 30) ....*Lichenophanes bicornis* (Web.)
16. Tarsal claw cleft; antenna shorter than maxillary palpus; mandible oblique, pointed ....*Dinapate wrighti* Horn
    Tarsal claw simple; antenna longer than maxillary palpus; mandible gouge-shaped..17
17. Posterior extensions from pharyngeal fulcrum not developed as pigmented rods (Fig. 43)..18

Posterior extensions from pharyngeal fulcrum developed as pigmented rods (Fig. 38)..19

18. Claws on second and third pairs of legs pigmented; scutum and scutellum of sixth abdominal segment forming a conspicuous transverse ridge (Fig. 39)........................*Xylobiops texanus* (Horn)

Claws on second and third pairs of legs not pigmented; scutum and scutellum of sixth abdominal segment not forming a conspicuous ridge................................*Xylobiops basillaris* (Say)

19. Sixth abdominal segment, dorsally, divided into two transverse areas (Fig. 36); lateral margins of foramen straight, nearly parallel (Fig. 42); anal lobes prominent..................................20

Sixth abdominal segment, dorsally, divided into three transverse areas (Fig. 35); lateral margins of foramen strongly curved (Fig. 41); anal lobes less prominent (Fig. 45)..........*Dendrobiella sericans* (Lec.)

20. Scutum of sixth abdominal segment prominent (Fig. 36)..*Scobicia bidentata* (Horn)

Scutum of sixth abdominal segment not prominent (Fig. 37)..*Scobicia declivis* (Lec.)

ENTOMOLOGY.—*New ichneumon-flies parasitic on the hemlock sawfly* (Neodiprion tsugae *Middleton*).[1] R. A. Cushman, U. S. Bureau of Entomology and Plant Quarantine. (Communicated by C. F. W. Muesebeck.)

Recent outbreaks of conifer-feeding sawflies of the genera *Diprion* and *Neodiprion*, both introduced and native species, have greatly increased the interest in and economic significance of the parasites of such insects. This has resulted in the rearing of large numbers of the parasites, many representing undescribed species, for which names are desired for use in economic and biological papers.

This paper consists of the descriptions of eight new species parasitic on the hemlock sawfly, *Neodiprion tsugae* Middleton, together with a few taxonomic and nomenclatorial notes pertinent to the main subject.

Genus **Ischnus** Gravenhorst

Ischnus Gravenhorst, Ichneumonologica Europaea **1**: 638. 1829.—Viereck, U. S. Nat. Mus. Bull. **83**: 78. 1914.

Habrocryptus Thomson, Opuscula entomologica, fasc. **5**: 471, 498. 1873.—Schmiedeknecht, Opuscula ichneumonologica, fasc. **7**: 502. 1904.

This is the *Ischnus* of the genotype, *porrectorius* (F.), not the phaeogenine genus *Ischnus* of European works. To it should be referred the following North American species:

[1] Received May 20, 1939.